yet they cannot naturally be moral. Thus, *e.g.*, self-interest is all in all with animals, but it can never lapse into selfishness, which is the *conscious* abuse of self-interest. We "punish" a dog, but we never look upon it as a criminal. So, too, no animal can ever act unjustly towards another, because it cannot be conscious either of justice or injustice. The abstract conceptions of righteousness and justice are only applicable to acts done *under a sense of righteousness and justice*. The same remark applies to personal immoralities; so that no animal can be immoral. That animals cannot entertain abstract ideas is not at all surprising, seeing how slow children are to do the same. A somewhat grotesque illustration will show this. A class of boys was asked what conscience was. None could explain it, so the teacher defined it as "something within you that tells you when you have done wrong." A boy at once exclaimed it was a stomach-ache. On inquiry it turned out that he had stolen and eaten some unripe fruit, and doubtless felt the *remorse* of conscience accordingly! If, then, my former position be qualified, I would restate it as corrected by the cases recorded as follows:—Animals reason as we do, but always in connection with concrete phenomena whether immediately apprehended by the senses, or present to consciousness through memory; but like children they are slow to perceive the suggestiveness of things. They have, morever, no power of conceiving truly abstract ideas. Hence they cannot be self-conscious, cannot conceive of God, and can neither be moral nor immoral, but are simply non-moral automata. On the other hand, that which rescues man from being an automaton pure and simple, is his power of conceiving of abstract ideas, which enables him to be self-conscious; consequently he can conceive of a personal, *i.e.* self-conscious Deity, so that he at once becomes a responsible being, and can be positively moral or immoral.

## *UNIVERSITY AND EDUCATIONAL INTELLIGENCE*

AT a recent meeting of the governors of Owens College, Manchester, the Committee on the proposed University charter presented a report. It appears that "negotiations have been actively carried on with the Council of the Yorkshire College, Leeds, partly by letter and partly by means of interviews between members of the respective committees. The suggestions agreed to by the Council of the Yorkshire College, Leeds, provide that the Owens College shall be named in the charter establishing the University as the first college in it; that the president and the principal of the Owens College shall be the first chancellor and vice-chancellor of the new University; that its *locus* shall be Manchester; and that in the system of proportionate representation proposed for the governing and the executive bodies of the University, the Owens College shall in either case begin with the maximum number of representatives allowed by the scheme." To obviate objection to a local name, that of Victoria University is suggested. The report and draft memorial were approved of, and the Committee were requested to make arrangements for the presentation of the memorial to the Lord President of the Privy Council at as early a date as possible, and for carrying out the other suggestions of the report, which was passed.

THE British Medical Association are getting up a memorial to the House of Commons urging the immediate institution at Oxford of a thorough medical curriculum, on the same basis as the medical schools of other English towns, in the following subjects at least:—Human anatomy, physiology of man, general pathology, materia medica, clinical medicine and surgery for beginners, State medicine, including jurisprudence and public health.

## *SCIENTIFIC SERIALS*

*American Journal of Science and Arts*, April.—An opening obituary notice of the distinguished botanist, Dr. Jacob Bigelow, who died in January, aged 92, is here followed by a note in which Prof. Marsh traces the connection between the two widely divergent forms of vertebræ of the toothed birds *Ichthyornis* and *Hesperornis*. In the former the articulation of the centrum is cup-shaped; in the latter the ends of the centrum are saddle-shaped, as in ordinary birds. The third cervical vertebra of Ichthyornis, however, has a transition form, affording a ready solution of the development of the modern avian vertebra from the fish-like. The order of development of vertebræ seems this: Biconcave vertebræ (fishes and amphibians), plane vertebræ (mammals), cup and-ball vertebræ (reptiles), saddle vertebræ (birds).—The double stars discovered by Mr. Alvan G. Clark, which (except Sirius) have not been brought to the attention of astronomers generally, are the subject of a paper by Mr. Burnham.—Interesting details are furnished by Prof. Church of underground temperatures in the Comstock lode in Nevada, where are, apparently, the hottest mines in the world. (The rock in the lower levels seems to have a pretty uniform temperature of 130° F.)—Prof. Lesquereux contributes a review of Count Saporta's valuable work on the plants of the world before man, taking occasion to compare the essential characters of certain tertiary groups of the North American continent, in order to determine some points still under discussion as to their age.—Mr. Palsinger indicates a method of estimating the thickness of Young's reversing layer; and among other subjects dealt with are, the lower jaw of Loxolophodon and the presence of chlorine in scapolites.

*Journal of the Franklin Institute*, April.—We note here the following:—Reports of the Committee on Science and the Arts, on Ainsworth's automatic switch for railroads, and a machine for treating flax, hemp, &c.—Tests of a Baldwin locomotive, by Mr. Hill.—The Franklin Institute standard screw thread.—The Butler mine fire cut off, by Mr. Drinker. In the course of investigations described in this last paper, Mr. Drinker thought it established that coal *in situ cannot* be burned *en masse*, but that the walls of carbonaceous slaty rock inclosing solid coal *can* be burned or calcined *in situ*. The mining engineers who discussed his paper seemed generally to be of opinion that the slates in the old fire were not actually burned, but that the carbonaceous matter in them was rather subjected to a process of distillation.

THE *Jornal de Sciencias mathematicas physicas e naturaes* (No. xxiv., December, 1878) contains the following papers:—On the oblique projection of a circle, by L. P. da Motta Pegado.—Contributiones ad floram mycologicam lusitanicam, by F. de Thuemen.—Ornithological notes, by J. V. Barboza du Bocage.—On the birds of the Portuguese possessions in West Africa (continuation), by the same.—On electrical condensation and the condensing force, by A. A. de Pina Vidal.—On a new densimeter, by Virgilio Machado.

THE quarterly *Revue des Sciences naturelles* (tome vii. No. 4) contains the following original papers:—Morphological researches on the family of *Graminеæ*, by D. A. Gordon.—Note on the genital organs and the propagation of some *Limacidæ*, by S. Jourdain.—Observations on the destruction and the development of the ovigerous capsule of *Blatta orientalis*, by G. Duchamp.—Catalogue of the land and river molluscs of the Hérault department, by E. Dubrueil (continuation).—Note on the soil of Montpellier, by P. de Rouville.—Note on the Pyrenees of the Aude, by M. Leymerie.

## *SOCIETIES AND ACADEMIES*

### LONDON

**Royal Society**, March 6.—"On the Characters of the Pelvis in the Mammalia, and the Conclusions respecting the Origin of Mammals which may be based on them." By Prof. Huxley, Sec. R.S., Professor of Natural History in the Royal School of Mines.

In the course of the following observations upon the typical characters and the modifications of the pelvis in the mammalia, it will be convenient to refer to certain straight lines, which may be drawn through anatomically definable regions of the pelvis, as *axes*. Of these I shall term a longitudinal line traversing the centre of the sacral vertebræ, the *sacral axis*; a second, drawn along the ilium, dorso-ventrally, through the middle of the sacral articulation and the centre of the acetabulum, will be termed the *iliac axis*; a third, passing through the junctions of the pubis and ischium above and below the obturator foramen, will be the *obturator axis*; while a fourth, traversing the union of the ilium, in front with the pubis, and behind with the ischium, will be the *iliopectineal axis*.

The least modified form of mammalian pelvis is to be seen, as might be expected, in the Monotremes, but there is a great difference between *Ornithorhynchus* and *Echidna* in this respect, the former being much less characteristically mammalian than the latter.

The distinctive features of the mammalian pelvis have been

clearly indicated by Gegenbaur,[1] who points out that in mammals, in contradistinction from reptiles, "the longitudinal axis of the ilium gradually acquires an oblique direction, from in front and above, backwards and downwards. The part which represents the crista above thus becomes turned forwards, or more or less outwards, with increase of lateral surface, the acetabular part backwards and downwards; hence the ischium retains its original direction in the produced long axis of the ilium, and, at the same time, takes up a position in relation to the vertebral column similar to that which obtains in birds. The conditions of this position are, however, to be sought in factors of a totally different nature in mammals from those which produce it in birds; for, in the former, the ischium follows the changed direction of the ilium, whilst in birds the ilium has nothing to do with the matter, and the ventral elements of the pelvis appear to pass towards the caudal region, independently of the ilium."

On one point, however, I cannot agree with Gegenbaur's conclusions. He is of opinion that the ilium of mammals answers to the post-acetabular part of the ilium of birds, and that "the *crista ossis ilii* of mammals corresponds with the posterior edge of the post-acetabular part of the bird's ilium. Between the two parts, therefore, there is the difference of a rotation through an angle of almost 180°." On the contrary, it appears to me evident that the whole *crista ilii* in a mammal corresponds with the whole dorsal edge of the ilium in a bird or a reptile, and that the angle through which the iliac axis rotates amounts to not more than 90°. I cannot reconcile the contrary view either with the relations of the ilium to the sacrum, or with the attachment of the muscles.

On comparing the pelvis of *Ornithorhynchus* with that of a lizard, or that of a chelonian, it will be observed that the resemblance between the former and the sauropsidan pelvis is, in most respects, closer than that which it bears to the higher mammalian pelvis. In the reptiles both the pubes and the ischia unite in a ventral symphysis; the pubis has a strong pectineal process, which acquires very large dimensions in the *Chelonia*; the metischial processes are also often very strong. Nevertheless, there is an important difference, for in all these animals the iliac axis is either nearly perpendicular to the sacral axis, or slopes from above downwards and forwards; the obturator axis also inclines downwards and forwards. Hence in most *Lacertilia* and *Chelonia*, the pubes slope forwards very obliquely, while the ischia come more and more forwards.

In other words, such modifications of the pelvis as occur in the Lacertilia and the Chelonia are of an opposite kind to those which take place in mammalia.

The same thing is true of the *Crocodilia*.

Thus it appears to be useless to attempt to seek among any known Sauropsida for the kind of pelvis which analogy leads us to expect among those vertebrated animals which immediately preceded the lowest known mammalia. For, if we prolong the series of observed modifications of the pelvis in this group backwards, the "pro-mammalia" antecedent to the Monotremes may be expected to have the iliac and obturator axis perpendicular to the sacral axis, and the iliopectineal axis parallel with it; something, in short, between the pelvis of an *Ornithorhynchus* and that of a land-tortoise; and provided, like the former, with large epipubes intermediate in character between those of the lower mammals and those of crocodiles. In fact, we are led to the construction of a common type of pelvis, whence all the modifications known to occur in the Sauropsida and in the mammalia may have diverged.

It is a well-known peculiarity of the urodele amphibia, that each *os innominatum* consists of a continuous cartilage, the ventral half of which is perforated by a foramen for the obturator nerve, but has no large fibrous fontanelle or obturator foramen in the ordinary sense of the word. As the junction of the dorsal with the ventral moiety, the acetabulum marks off the iliac portion of the pelvic arch above, from the pubic and ischial regions below; and these are further distinguishable, even apart from their ossifications, by the position of the foramen for the obturator nerve and the origins of the muscles. In full-grown specimens of *Salamandra maculosa* the pelvis presents the following characters:—The iliac axis is slightly inclined forwards, while the iliopectineal axis is practically parallel with the sacral axis. The iliac ossification extends into the acetabulum, and forms a triangular segment of its roof with the apex downwards, exactly as in lizards. The posterior and inferior side of the triangle is separated by a thin band of the primitive cartilage from the upper edge of the similarly triangular cotyloid end of the ischial ossification, the anterior edge of which is vertical again as in lizards. Between this edge and the anterior and inferior edge of the iliac ossification there is a cartilaginous interspace, as in crocodiles, which represents the cotyloid end of the pubis. This cartilaginous part of the pubis gives rise to a pectineal process, which has the same position as in birds and in *Ornithorhynchus*. In the floor of the acetabulum the pubic ossification makes its appearance as a very thin lamina, which extends, underneath the pectineal process, inwards; and gradually surrounds the whole of the thickened transverse ridge of cartilage which corresponds with the pubis. The pubis is thus represented by an axis of cartilage surrounded by bone, and the thick inner extremities of the two pubes are largely united by fibrous tissue. The ischia are relatively large, and are united, partly by cartilage and partly by ligament, in a long symphysis. Their posterior and external angles are produced into short metischial processes. In one specimen I observed a distinct sutural line between the anterior curved edge of the right ischium and the corresponding pubis, while no such suture could be traced upon the other side.

The pelvic arch of *Salamandra*, therefore, contains all the elements which are found in the higher vertebrata, but the obturator fontanelle is wanting, and it seems to me that in such a pelvis we have an adequate representation of the type from which all the different modifications which we find in the higher vertebrata may have taken their origin.

In the lizards and the *Chelonia* the iliac and obturator axes have inclined forwards, and the epipubes have been reduced to such rudiments, as have been described in chameleons and in some tortoises.[1]

In the crocodiles, with the same general pelvic characters, the cotyloid end of the pubis retains its imperfectly ossified condition, while the epipubes represent the vastly enlarged rami of the salamandrine epipubis.

In the Ornithoscelida and in birds, the ilia elongate, but it is the modification of the pubes and ischia which is the most characteristic feature of the pelvis, and the epipubis vanishes.

In the Pterosauria and in the Dicynodonts, the salamandrine non-development of an obturator fontanelle persists; and, in the former, the sessile rami of the epipubis appear to be represented by the so-called marsupial bones.

Unless the like should prove to be the case in the Dicynodonts, it is in the mammalia alone that the subsacral portion of the ilium elongates backwards, carrying with it the pubis and the ischium, between which a large rounded obturator fontanelle is developed.

These facts appear to me to point to the conclusion that the mammalia have been connected with the amphibia by some unknown pro-mammalian group, and not by any of the known forms of Sauropsida; and there is other evidence which tends in the same direction.

Thus, the amphibia are the only air-breathing vertebrata which, like mammals, have a dicondylian skull. It is only in them that the articular element of the mandibular arch remains cartilaginous; while the quadrate ossification is small, and the squamosal extends down over it to the osseous elements of the mandible; thus affording an easy transition to the mammalian condition of these parts.

The pectoral arch of the Monotremes is as much amphibian as it is sauropsidan; the carpus and the tarsus of all Sauropsida, except the Chelonia, are modified away from the urodele type, while those of the mammal are directly reducible to it; and it is perhaps worth notice, that the calcar of the frogs is, in some respects, comparable with the spur of the Monotremes.

Finally, the fact that in all Sauropsida it is a right aortic arch which is the main conduit of arterial blood leaving the heart, while, in mammals it is a left aortic arch which performs this office, is a great stumbling-block in the way of the derivation of the mammalia from any of the Sauropsida. But if we suppose the earliest forms of both the mammalia and the Sauropsida to have had a common amphibian origin, there is no difficulty in the supposition that, from the first, it was a left aortic arch in the one series, and the corresponding right aortic arch in the other, which became the predominant feeder of the arterial system.

The discovery of the intermediate links between reptilia and

[1] "Beiträge zur Kenntniss des Beckens der Vögel," *Jenaische Zeitschrift* vi.

[1] Hoffman, "Beiträge zur Kenntniss des Beckens der Amphibien und Reptilien," *Nied. Archiv für Zoologie*, 1876.

aves, among extinct forms of life, gives every ground for hoping that, before long, the transition between the lowest mammalia at present known and the simpler vertebrata may be similarly traced. The preceding remarks are intended to direct attention to the indications of the characters of these pro-mammalian vertebrata, which the evidence at present forthcoming seems to me to suggest.

In the relatively large size of the brain, and in the absence of teeth, the only existing representatives of the Ornithodelphia present characters which suggest that they are much modified members of the group. On comparing the brain of *Echidna*, for example, with that of many marsupialia and insectivora, its relative magnitude is remarkable: and, in view of the evidence which is now accumulating, that the brain increases in size in the later members of the same series of mammalia, one may surmise that *Echidna* is the last term of a series of smaller-brained Ornithodelphia. Among the higher vertebrata I think that there is strong reason to believe that edentalous animals are always modifications of toothed forms.

**Institution of Civil Engineers**, April 22.—Mr. Bateman, president, in the chair.—The paper read was on dioptric apparatus in light-houses for the electric light, by Mr. James T. Chance, Assoc. Inst. C.E.

PARIS

**Academy of Sciences**, April 24.—M. Daubrée in the chair.—The following papers were read:—On the condition of the roadstead of Port Said, by M. De Lesseps. The bottom appears to have reached a state of equilibrium, and the dredging operations carried out annually will suffice to maintain this state. The sand deposits, opposed by dredging, are chiefly formed to the north and north-east of the large jetty, in a region reaching about 800 to 1,000 metres from its base. Beyond this, as also to the west, the deposits are more muddy, and are carried away by the action of the sea. M. De Lesseps also spoke hopefully of the Congress to meet on May 15, for determining the best course for an inter-oceanic canal (which he thinks will be achieved before the close of this century).—Complementary researches on the products of distillation of alcohols, by MM. Pierre and Puchot. The authors reproduced synthetically most of the phenomena observed, by operating on aldehydes.—On the navisphere, a nautical instrument, by M. De Magnac. This gives, without calculation, and in a few seconds, the names of the stars that are above the horizon at a given moment; also very approximately, the altitudes and azimuths of these stars; also the angle of route for going from one point to another by the arc of a great circle, and the distance between these points. The instrument has been tried on the steamship *Washington* with excellent results.—Experimental researches on the metallic grains of sporadosideric meteorites, by M. Meunier. The grains are essentially angular and branching, and do not seem to have passed through fusion. They often form envelopes round stony elements of cosmic rock. The Greenland masses of native iron (whose grains are of this character) cannot be thought the product of reduction of the dolerite by the lignite through which they have been erupted. M. Meunier considers them brought from a great depth with ordinary basalt, in which they had been embedded.—On the artificial production of bioxide of manganese, by M. Gorgeu. Artificial bioxide, having all the properties of polianite and pyrolusite, was got by heating, gently and long, at a temperature of 155° to 162°, nitrate of manganese in a glass phial placed in a bath of oil or paraffin. Other methods were tried without success. The authors are of opinion that, in formation of polianite and pyrolusite, the iron suspended in the very fluid mass of fused nitrate of manganese was decanted before decomposition of the nitrate occurred; and the same with all other powdery products mixed with the nitrate.—On tritungstates, by M. Lefort.—On the methodic employment of coloured glasses in achromatopsy, by M. Coursserant. May not the exclusive excitation of certain nerve elements of the retina cause to be produced and accumulated, in certain elements in repose, a quantity of work which will manifest itself in the form of variously coloured light, when these rested elements, solicited in turn, come into action?—Observations of Jupiter's satellites, at the Toulouse Observatory in 1878, by M. Baillaud.—Formation of a function, $F(x)$, possessing the property $F[\phi(x)] = F(x)$, by M. Appel.—Letter to M. Dumas on the apparatus of Lavoisier, by M. Truchot. The Conservatoire des Arts et Métiers contains about a dozen of Lavoisier's instruments, chiefly relating to synthesis of water and calorimetry. But this is not all that remains; his chemical laboratory and physical cabinet have been piously preserved by his family. They are now in possession of M. de Chazelles, at Canière, near Aigue-perse (Puy de Dôme), and M. Truchot has made an inventory of them, which he here gives briefly. Many of the instruments are of great interest.—Chemical function of anhydrous acetic acid, by M. Loir. It presents the general properties characterising aldehydes.—On nitrosoguanidine, by M. Jousselin. He indicates a method of obtaining it in considerable quantities, and describes several of its reactions.—On the value of certain chemical agents employed in dyeing with aniline black, by M. Witz. The proved inertia of chromium in mixtures with chlorates contrasts singularly with the marvellous energy of vanadium, the industrial use of which presents the greatest economical advantages.—On the formation of hail, by M. Oltromare. Suppose the temperature of a considerable cloudy mass (formed by cooling and condensation of saturated air and electricity keeping the molecules apart) to go down to −14°, implying a state of *surfusion*,—and the electricity of the mass suppressed by discharge, the molecules then clashing together will be changed into pieces of ice more or less coherent.—On the amyloid appearance of cellulose in champignons, by M. de Seynes.—On the mode of formation of biliary canaliculi in hepatitis, and the consecutive production of tubulated glands in the liver of the rabbit, by MM. Nicati and Richaud.—M. Jaubert claimed priority with regard to the MM. Henry's new catadioptric telescope. M. Faye pointed out, however, that MM. Henry did not seek to modify the optical power of reflectors by addition of a large refracting lens, but simply to close the tube so as to suppress movements of the interior air.—M. Larry presented the catalogue of the South Kensington Loan Collection (third edition), accompanied with a French Guide.

VIENNA

**Imperial Academy of Sciences**, March 6.—The following among other papers were read:—On the new recurrence of halotrichite and melanterite at Idria, by Prof. Zepharovich.—On the electrical perforation of glass, by Prof. Waltenhofen.—On the decomposition of formiate of ammonium at a high temperature, by Herr Andreasch.—On determination of the co-efficient of internal friction in viscous liquids by gravitation experiments, by Herr Schröttner.—On direct introduction of carboxyl groups into phenols and aromatic acids, by Prof. Senhofer and Dr. Brunner.—On facts of experience lying at the base of mechanics, by Herr Heller.—Muscular system of the extremities of the orang, by Prof. Langer.—On lacunar consumption of striped muscular fibres, by Prof. Klemmsiewicz.—Eruptive rocks of the western Balkans, by Prof. Niedzwiedzki.—Theory of the metallic thermometer, by Herr Jüllig.

March 13.—Remarks on the telephone, by Prof. Boltzmann.—On a new substance, nitroso-sulphhydantoin, by Prof. Naly and Herr Andreasch.—On resorcin-sulpho-acids, by Herr Fischer.

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